HISTORIC PROPERTY INVENTORY FORM

State of Washington, Department of Community Development
Office of Archaeology and Historic Preservation
111 21st Avenue Southwest, Post Office Box 48343
Olympia, Washington 98504-8343 (206)753-4011

IDENTIFICATION SECTION

Field Site No. 105-KW **OAHP No.** ______ **Date Recorded** 25-Apr-98
Site Name Historic Reactor Building
Common ______
Field Recorder Jim Sharpe
Owner's Name U.S. Department of Energy, Richland Operations Office
Address P.O. Box 550
City/State/Zip Code Richland, WA 99352

LOCATION SECTION

Address Building 105 KW, 100-K Area
City/Town/County/Zip Code Richland/Benton County/99352
Twp 13 **Range** 26 **Section** 32 **I/4 Section** SW **1/4 1/4 Sec** SW
Tax No./Parcel No. ______ **Acreage** ______
Quadrangle or map name Coyote Rapids ,Washington Quad-7.5min series 1986
UTM References Zone 11 **Easting** 301440 **Northing** 5169320
Plat/Block/Lot ______
Supplemental Map(s) ______

Status
- [x] Survey/Inventory
- [ ] National Register
- [ ] State Register
- [ ] Determined Eligible
- [ ] Determined Not Eligible
- [ ] Other (HABS, HAER, NHL)
- [ ] Local Designation

Photography
Photography Neg. No. (Roll No. & Frame No.) 83G195-56cn
View of KW-Reactor
Date 9/16/83

Classification [ ] District [ ] Site [x] Building [ ] Structure [ ] Object
District Status [x] NR [ ] SR [ ] LR [ ] INV
Contributing [x] **Non-Contributing** [ ]
District/Thematic Nomination Name Hanford Site Manhattan Project and Cold War Historic District

Description Section

Materials & Features/Structural Types
Building Type Industry
Plan ______
Structural System Reinforced concrete
No. of Stories ______

Roof Type
- [ ] Gable
- [x] Flat
- [ ] Monitor
- [ ] Gambrel
- [ ] Shed
- [ ] Hip
- [ ] Pyramidal
- [ ] Other (specify)

Cladding (exterior Wall Surfaces)
- [ ] Log
- [ ] Horizontal Wood Siding
  - [ ] Rustic/Drop
  - [ ] Clapboard
- [ ] Wood Shingle
- [ ] Board and Batten
- [ ] Vertical Board
- [ ] Asbestos/Asphalt
- [ ] Brick
- [ ] Stone
- [ ] Stucco
- [ ] Terra Cotta
- [x] Concrete/Concrete Block
- [ ] Vinyl/Aluminum Siding
- [ ] Metal (specify)
- [ ] Other (specify)

Roof Material
- [ ] Wood Shingle
- [ ] Wood Shake
- [ ] Composition
- [ ] Slate
- [ ] Tar/Built-up
- [ ] Tile
- [ ] Metal (specify)
- [ ] Other (specify)
- [x] Not visible

Foundation
- [ ] Log
- [ ] Post & Pier
- [ ] Stone
- [ ] Brick
- [ ] Not visible

Concrete
- [ ] Block
- [x] Poured
- [ ] Other (specify)

Integrity (Include detailed description in **Description of Physical Appearance)**

	Intact	Slight	Moderate	Extensive
Changes to plan		x		
Changes to windows				
Changes to original cladding	x			
Changes to interior		x		
Other (specify)				

High Styles/Forms (Check one or more of the following)
- [ ] Greek Revival
- [ ] Gothic Revival
- [ ] Italianate
- [ ] Second Empire
- [ ] Romanesque Revival
- [ ] Stick Style
- [ ] Queen Anne
- [ ] Shingle Style
- [ ] Colonial Revival
- [ ] Beaux Arts/Neoclassical
- [ ] Chicago/Commercial Style
- [ ] American Foursquare
- [ ] Mission Revival
- [ ] Spanish Colonial Revival/Mediterranean
- [ ] Tudor Revival
- [ ] Craftsman/Arts & Crafts
- [ ] Bungalow
- [ ] Prairie Style
- [ ] Art Deco/Art Moderne
- [ ] Rustic Style
- [ ] International Style
- [ ] Northwest Style
- [ ] Commercial Vernacular
- [ ] Residential Vernacular (see below)
- [x] Other (specify) Industrial Vernacular

Vernacular House Types
- [ ] Gable Front
- [ ] Gable Front and Wing
- [ ] Side Gable
- [ ] Cross Gable
- [ ] Pyramidal/Hipped
- [ ] Other (specify)

NARRATIVE SECTION

Study Unit Themes (check one or more of the following)

[ ] Agriculture	[ ] Conservation	[ ] Politics/Government/Law
[ ] Architecture/Landscape Architecture	[ ] Education	[ ] Religion
[ ] Arts	[ ] Entertainment/Recreation	[ ] Science & Engineering
[ ] Commerce	[ ] Ethnic Heritage (specify)	[ ] Social Movements/Organizations
[ ] Communications	[ ] Health/Medicine	[ ] Transportation
[ ] Community Planning/Development	[ ] Manufacturing/Industry	[x] Other (specify) Manhattan Project & Cold War Era
	[ ] Military	[x] **Study Unit Sub-Theme(s)** Reactor Operations

Statement of Significance

Date of Construct 1952-1955 Architect/Engineer/Builder Kaiser Engineers

[x] In the opinion of the surveyor, this property appears to meet the criteria of the National Register of Historic Places.

[x] In the opinion of the surveyor, this property is located in a potential historic district (National and/or local).

The 105-KW Reactor Building was located in eastern Washington at the Hanford Site in the K-West Reactor Area. The reactor was designed as a plutonium production reactor larger in size than its predecessors and capalbe of about twice the production. The building housed the reactor and the primary auxiliary equipment that included the reactor block, irradiated fuel storage basin, ventilation system and work areas. It was constructed with a structural steel framework supporting floors, equipment and inner wall, and covered with corrugated asbestos siding. For sheilding purposes some of the inside and outside walls were constructed of concrete. The foundation consisted of heavy concrete footings 25 feet thick. The building is boxlike in appearance, pyramided in five primary tiers.

See continuation sheet.

Description of Physical Appearance

Major Bibliographic References

See continuation sheet.

Historic Property Inventory Form
105-KW Reactor
Continuation Sheet

Statement of Significance, continued

The 105-KW Reactor Building was located in what was commonly referred to as the K-Reactor Area, which contained the KW and KE-Reactors and associated support facilities. The KW-Reactor was located about 2,000 feet west of the KE-Reactor. The reactors were located about 25 miles northwest of Richland, Washington on the Hanford Site. The K-Reactor area is located on the south shore of the Columbia River between the 100-B and 100-D Reactor Areas. The physical location of the two K-Reactors was designed to allow for an adequate water supply and the transfer of process water, river water, and electrical power between each reactor (HW-26414).

In 1951, the Atomic Energy Commission Headquarters issued a letter requesting an increase in production facilities at Hanford. The request resulted in the construction of the K-Reactor Area. The K-Reactors and their associated facilities were part of " Project X", an expansion program designed to: 1) construct additional reactors, 2) construct new separations plants, 3) expand metal processing facilities and, 4) provide certain facilities required for the new construction, and for operation of the new plants.

Because of their size, the K-Reactors were known as "Jumbo" Reactors. They were designed as plutonium production facilities larger than their predecessors and capable of about twice the production. The new design, called the "X" type, was different from previous reactor design in that they had a greater production capacity. The increased capacity was the result of both the larger size of the reactors and a reduction of lattice spacing. The reduction in lattice spacing allowed for a larger uranium load in relation to unit size. This increase in size also required an increase in the amount of cooling water for reactor operations. Increasing cooling water circulation allowed the reactors to operate at a higher level of reactivity with greater production and reduced costs (HW-24800-103). The KW-Reactor operated from 1955 until 1970.

Construction of the KW-Reactor began in 1952 as part of the Atomic Energy Commission's goal to expand the production of weapons grade plutonium to meet military requirements and national security. Kaiser Engineers was the primary contractor for the project. In order to meet operational requirements, the building contained five primary work areas that included a storage basin/transfer area, fan house, process area, valve pit and work area, and office area. It also housed the reactor and the primary auxiliary equipment. It was constructed of structural steel framework supporting floors, equipment and inner walls. The framework was covered with corrugated asbestos siding. For shielding purposes some of the inside and outside walls were constructed of concrete. The foundation consisted of heavy concrete footings twenty-five feet thick.

The multi-story building was box-like in appearance, pyramided in five primary tiers (HW-24800-103) (Fig. 1). The height of the building was 107 feet. The roof deck contained 6,655 square feet of reinforced concrete and 50,400 square feet of corrugated asbestos roof decking.

The dimensions of the building at ground level were 213 feet long x 275 feet wide with a floor area of 110, 259 square feet.   The ground floor was 20 feet 9 inches below grade. For functional purposes, the floor plan was divided into rooms of irregular size and shapes (Figs 2-5). Generally, dividing walls were constructed of heavy concrete for shielding purposes with thin walls used for offices, locker areas and lunch rooms, located on the east side of the building. The process area, which contained the reactor was in the center of the building and measured 56 feet long x 46 feet wide. The work area was 68 feet long x 61 feet wide and extended to the south wall of the reactor area. Concrete walls for the structure vary from 6 inches to 5 feet in thickness. The shell of the building contained 872 tons of structural steel. Overall, there was 1,842 tons of concrete reinforcing steel in the building.

REACTOR OPERATIONS

The primary nuclear process of the 105-KW Reactor was the transmutation of U-238 to Pu-239 and the fissioning of U-235 (HW-74095). Reactor operations included fuel and target loading and removal, control and cooling of its operations, and maintenance and modification. The 105-KW Reactor received canned uranium slugs, also known as fuel elements, by truck from the 300 Area. The slugs were made of metallic natural uranium and were charged into the reactor process tubes at the front face of the reactor.   Once the slugs were charged, they were irradiated, then discharged from the rear face into a water filled metal storage basin. From the storage basin ,the material was placed in special buckets and stored for a controlled length of time, then transported by railroad cask cars to the 200-Areas for the separations process.

The reactor process required large quantities of cooling water from the Columbia River. The water was pumped from the river pumping station to the filter plant and temporarily stored in a water reservoir. From the reservoir, water was pumped through the reactor for cooling purposes and to other facilities throughout the plant for miscellaneous uses. Water discharged from reactor operations was known as effluent water and gravity flowed through pipes into retention basins. The retention basins held the effluent water for a period of time to allow short-term radionuclides to decay prior to its release back into the Columbia River.

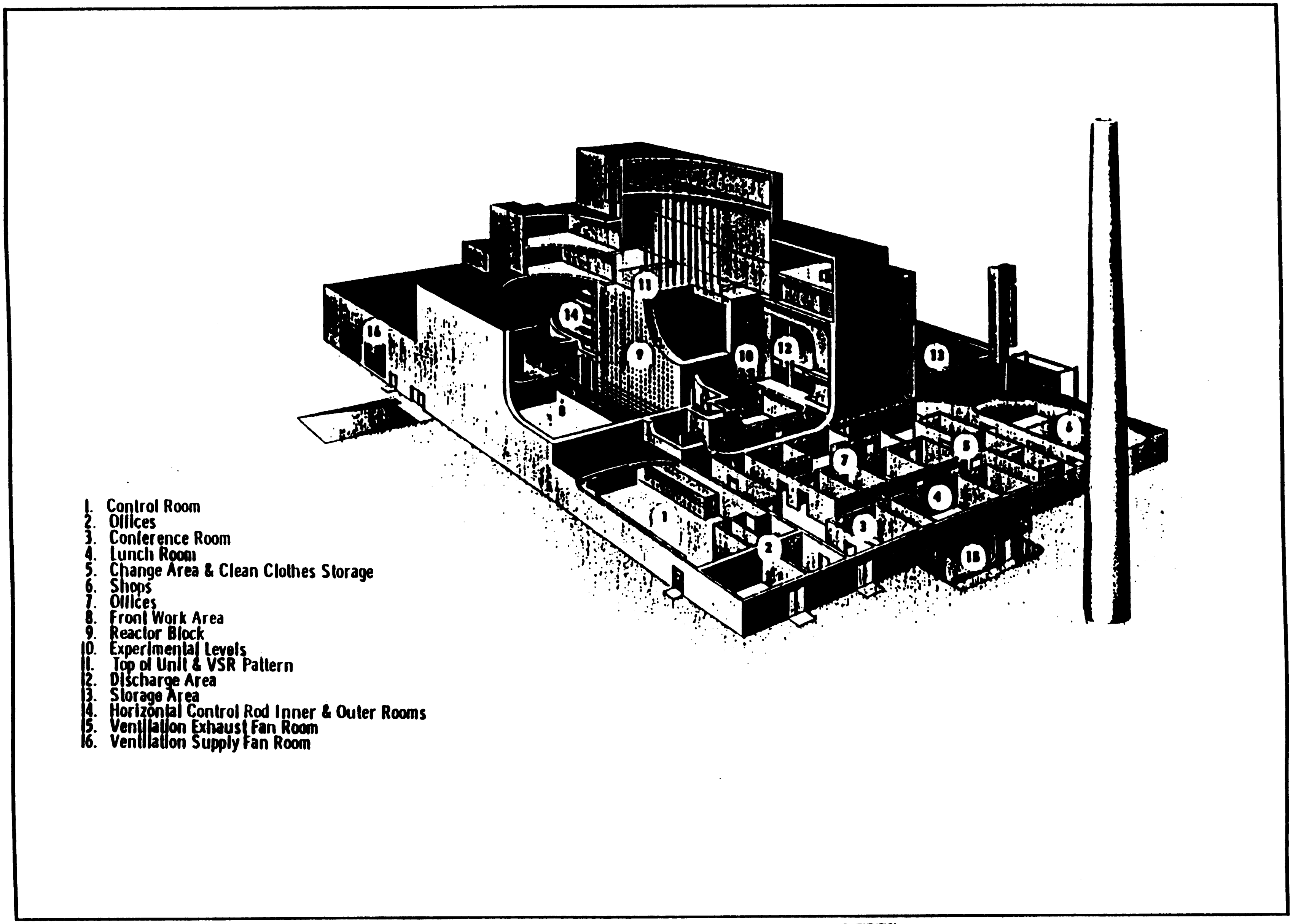

Figure 1: Layout of the 105-KW Building. Source: HW-74095 Vol. 3.

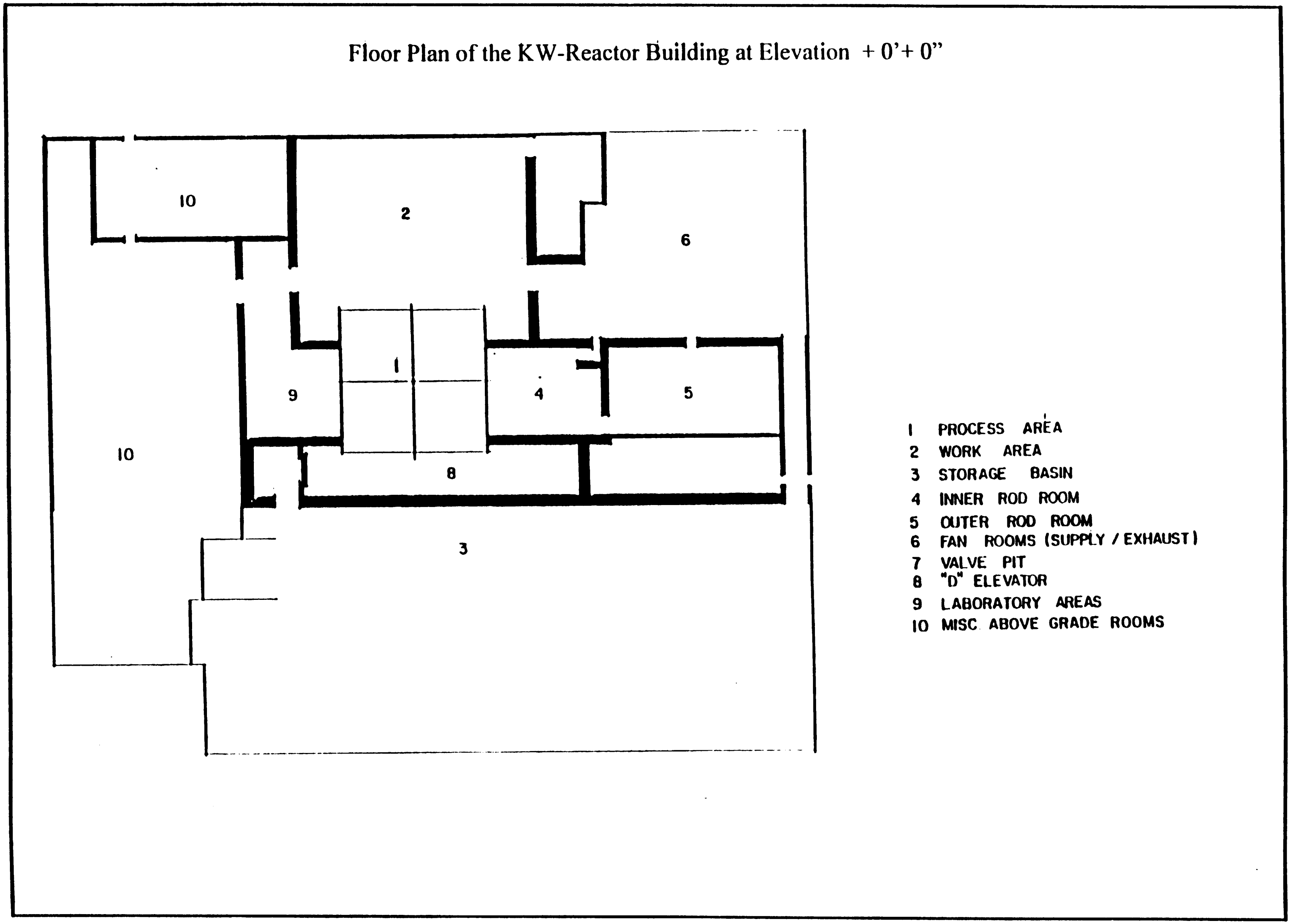

Figure 2: Floor Plan of the KW-Reactor at the 0 Foot Elevation.
Source: UNI-2898 Rev. 0

Floor Plan of the KW-Reactor Building at Elevation + 44' + 0"

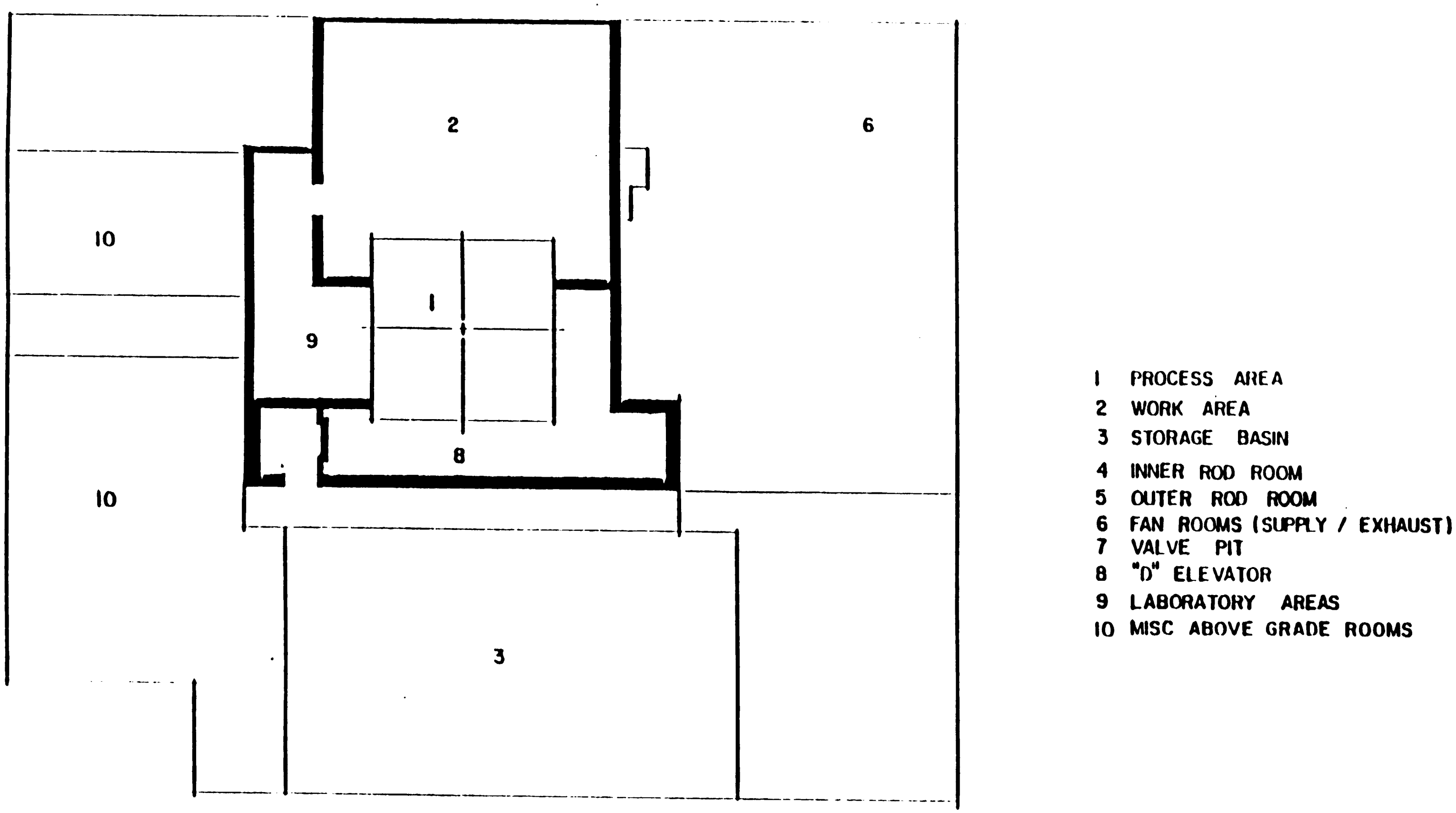

Figure 3: Floor Plan of the KW-Reactor at the 44 Foot Elevation.
Source: UNI-2898 Rev. 0.

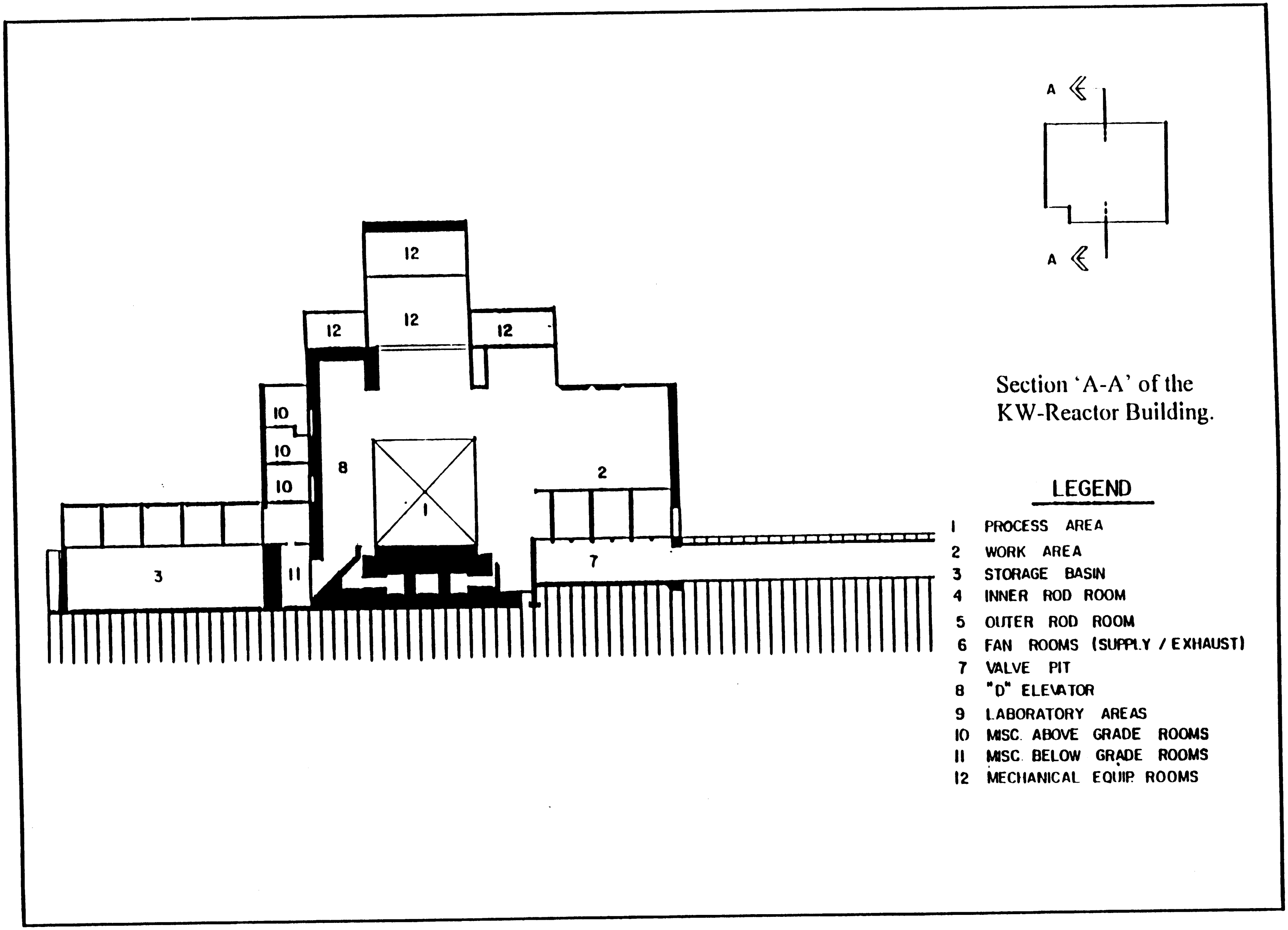

Figure 4: Section Plan of the KW-Reactor. Source: UNI-2898 Rev. 0.

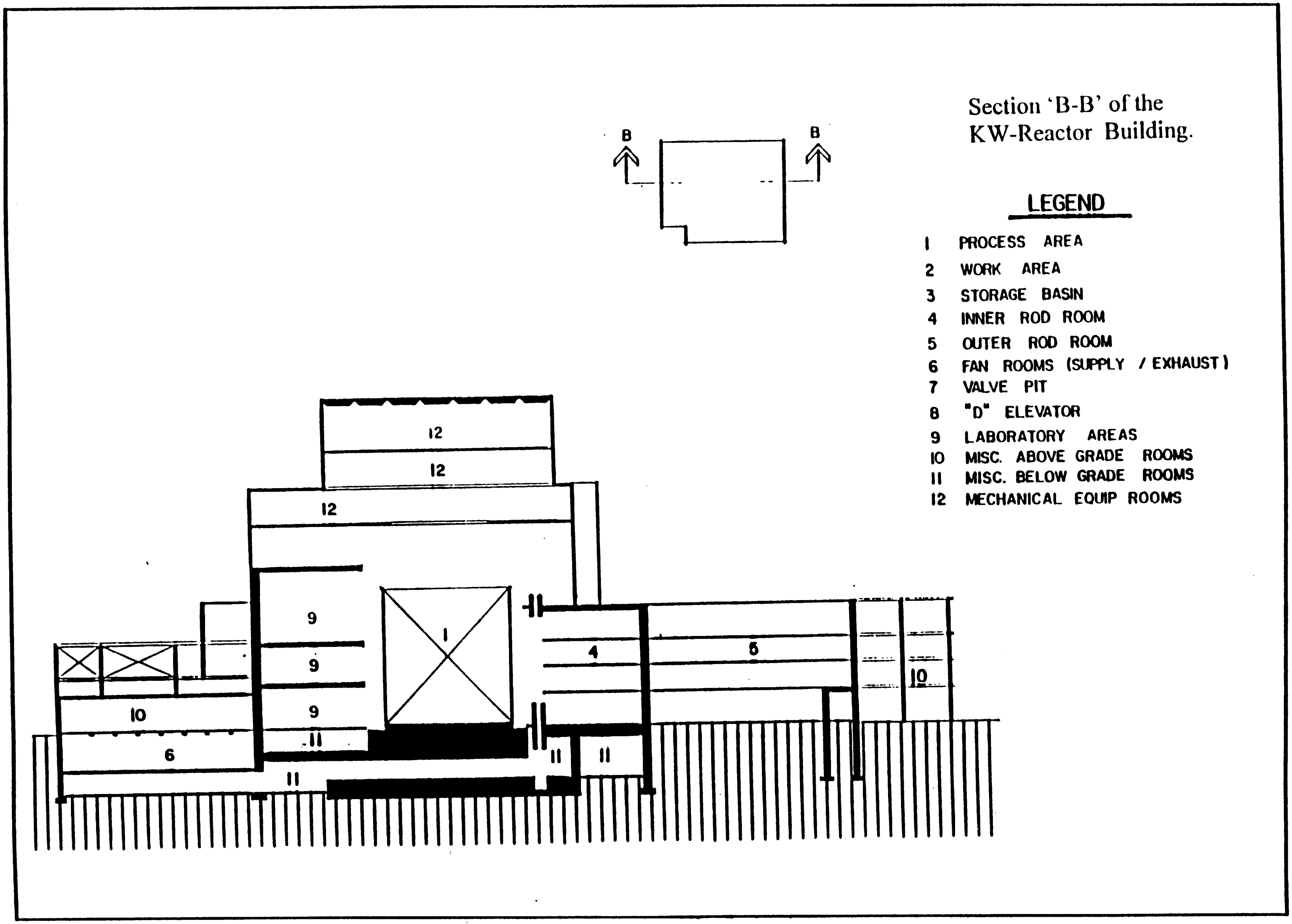

Figure 5: Section Plan of the KW-Reactor. Source: UNI-2898 Rev. 0.

REACTOR BLOCK

The reactor block was in the center of the 105-KW Reactor Building. The reactor block consisted of a graphite moderator stack encased by cast-iron thermal shielding and a concrete biological shield, process tubes, and safety and control systems. The stack was constructed of graphite blocks 3-3/4 inches square by 48-inches long (Fig. 6). Blocks were staggered to provide increased stability. The base of the graphite stack rested on a leveled surface of cast iron blocks that were laid in grout on top of a large concrete foundation. Alternate blocks in the front-to-rear oriented layers were pierced for 3,220 process channels that provided space for process tubes (HW-74095 Vol. 3).

Several different types of holes were constructed into the reactor stack that included: 1) twenty horizontal control rods that entered on the left side, 2) twelve experimental test holes that extended from side-to-side through the reactor, and four front-to rear test holes, 3) seven channels used for measuring graphite distortion extended from side-to-side through the reactor and five front-to-rear channels, 4) nine channels used for measuring graphite temperatures extended from side-to-side through the reactor, 5) fifty one vertical safety rod channels extended from the top to the bottom of the reactor, 6) and four holes on each side were used to monitor reactor flux distributions (HW-74095 Vol. 3).

The reactor block weighed about 11,000 tons and was 44 feet from front to rear by 53 feet side to side and 50 feet from top to bottom. It rested on a massive concrete foundation (WHC-SD-EN-TI-239). By comparison, the reactor block for the 105-B Reactor (one of the first three built on the Hanford site) measured 28 feet long by 36 feet wide by 36 feet high.

STORAGE BASIN

The storage basin was designed to provide shielding and cooling for the irradiated fuel during reactor operations and serve as a collection, storage, and transfer facility. Spent fuel rods were discharged into the basin for storage. From the north wall of the 105-KW Reactor extending to an open area behind the reactor was the underground storage basin. The concrete tank facility was 136 feet long by 70 feet wide by 22 feet deep. Three concrete pools (west, center, and east bays) made up the storage basin, each divided into separate sections about 20 feet below grade. Each pool contained water with an average depth of about 16 feet (WHC-SD-SNF-PLN-004). In 1974 and 1975, the storage basin was modified to a volume capacity of 200,000 cubic feet (WHC-SD-EN-TI-239, Rev. 0).

Operations of the storage basin system included temperature control, pH monitoring, cartridge filters, recirculation pumps, sand filters, and ion exchange columns. Water temperature in the basins was maintained near 50 degrees Fahrenheit. Corrosion control of the

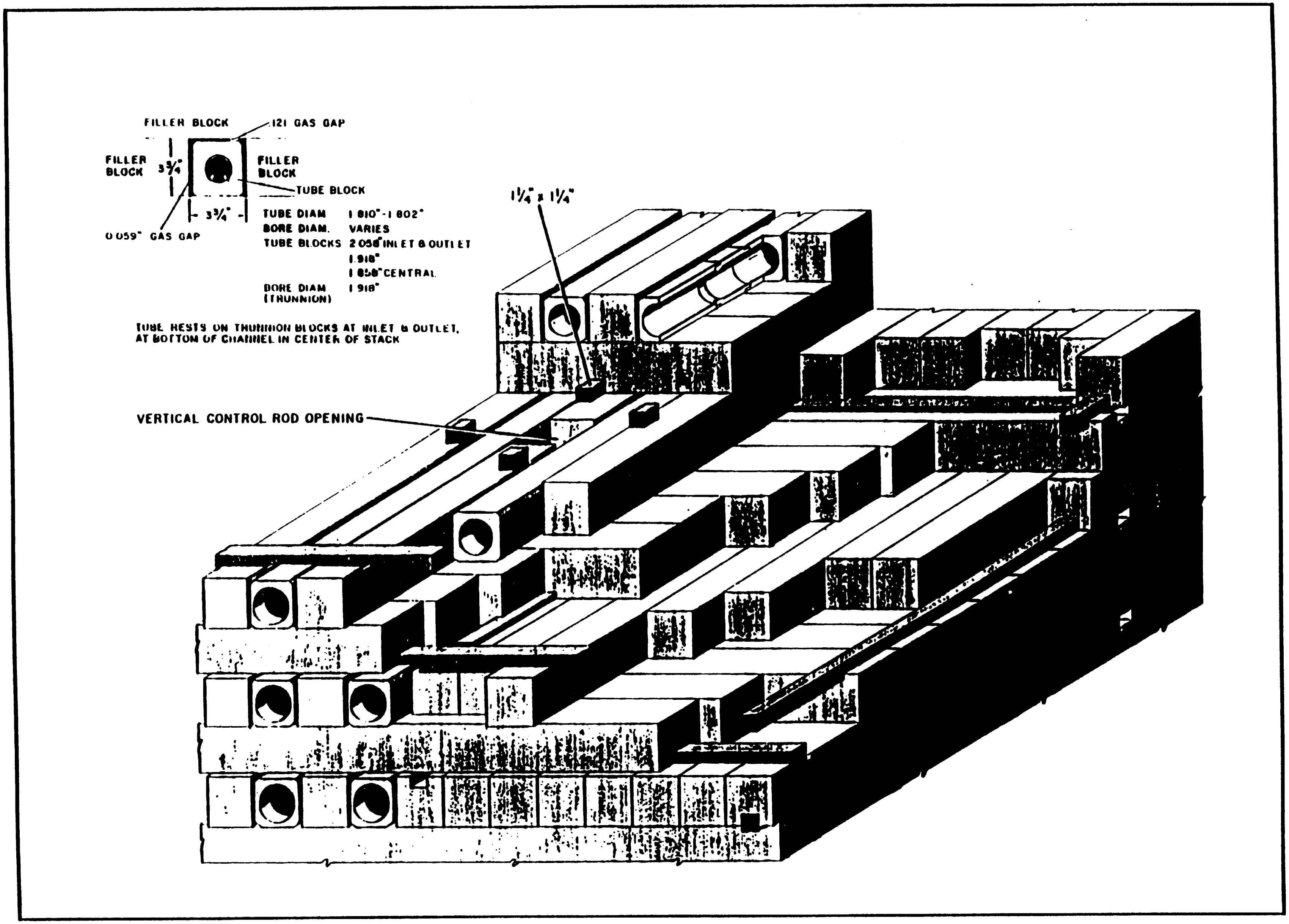

Figure 6: Reactor Moderator Graphite Stack in the KW-Reactor Building.
Source: HW-74095 Vol. 3.

metals in the basins was achieved by maintaining the pH of the water between 5.2 and 9.5. Recirculation pumps transported water through underwater header pipes in each bay through a cartridge filter then routed it through a chiller to remove residual decay heat. The sand filters and ion exchange columns were part of a second water processing system designed to remove suspended particulates from the water by pumping water through a large sand filter then through ion exchange modules and into the storage basins. (WHC-SD-SNF-PLN-004, Rev. 0).

TRANSFER AREA

The transfer area contained two sets of railway tracks of standard gauge that extended into the building at ground level through the west wall. Next to each track was a loading pit leading from the main basin. Irradiated slugs dropped from the rear face of the reactor through a discharge gate to the bottom of the bay between the reactor and basin.

VIEWING AND WEASEL PITS

Viewing and weasel pits contained equipment used to examine and manipulate slugs stored under water. The water provided a shielding layer to protect the handler from radiation exposure.

MAIN CONTROL ROOM

The main control room was located at the east end of the work area on the south side of the reactor building and was 69 feet long by 33.5 feet wide. It contained 21 panels used for critical control and instrumentation. The panels were seven feet high and up to six feet wide. A narrow galley ran behind the panels for conduit and maintenance access. Instrumentation in the room monitored various operation functions that included: gas temperatures, blower speed, gas dryer rooms, condensate levels, cooling water, water temperatures, pressures, and levels, water effluent from various locations, effluent water radioactivity, oil pumps, heater-cooler, auxiliary blower controls and pressure indicators, inlet and outlet gas pressure, dewpoint of gas samples, thermal and biological shield water flow, cross-tie line flow, total flow, horizontal rod position indicators, automatic trip for vertical rods the ball 3X system, or by pass systems, and safety circuits, (HW-24800-103).

INNER AND OUTER HORIZONTAL CONTROL ROOMS

The inner and outer horizontal control rooms were located near the west central section of the 105-KW Reactor Building between the process area and the west outer wall. The inner control room housed the inner sections of the rods that extended into the reactor for reactor control during withdrawal periods. The area was 39 feet 9 inches long by 29 feet 5 inches wide (HW-24800-103). The outer horizontal control room housed the drive extensions and mechanisms and was 60 feet long x 31 feet wide. Heavy concrete walls from 1.5 feet to 5 feet thick shielded both rooms.

VENTILATION AND EXHAUST SYSTEM

The 105-KW Reactor ventilation system provided a constant flow of fresh, dust-free air throughout the building. The system was designed for dual purposes, to supply clean air and collect radioactive dust particles. Clean air entered the building and was first routed through duct work to low contamination work areas then over potentially radioactive areas, and finally picked up by an exhaust system and evacuated from the windowless building. This was accomplished by conditioning outside air then distributing it throughout the building using a fan and distribution network.

Air entered the reactor building through louvers near ground level. Once air entered the building it was pushed by two large electric fans through a 8-foot by 6-foot main duct that extended across the building. Ventilation air from outside the confinement zone was exhausted through the roof into the atmosphere. Confinement zone air flowed toward the front face of the reactor, up the face and over the top of the reactor and was collected in an exhaust duct and discharged into the exhaust tunnel. Air supplied through the outer-rod room entered the inner-rod room then into the exhaust tunnel. Supply air for the rear face enclosure entered the top of the reactor and was exhausted directly into the exhaust tunnel. X-levels supplied air was collected in ductwork then discharged into the exhaust tunnel. From the exhaust tunnel the air was pressurized by exhaust fans then by a duct system traveled to the filter building then to the exhaust stack (HW-74095 Vol. 3). From the exhaust stack it was released into the atmosphere.

117 Filtration Facility

The 117 Filter Building contained the filter system for exhausted air from the 105 KW- Reactor Building. The Filter Building was connected to the reactor building by two underground concrete ducts. The building contained 32 filters in a frame; four frames made up a filter bank. There are 144 filters per bank in the facility. From the 117-KW Filter Building, the air entered into the 116-KW Exhaust Stack.

EXHAUST STACK

The 116-KW Exhaust Stack was east of the105-KW Reactor Building. The stack was 315 feet tall and 20.5 feet in diameter at the base and 10 feet in diameter at the top. The walls varied in thickness from about 18 inches near the base to about 12 inches at the top. The stack was used to release air into the atmosphere and reduce the possibility of radioactivity near the plant.

INSTRUMENTATION AND SAFETY CIRCUITS

Numerous types of instrumentation and safety circuits were installed in the reactor system. For example, neutron flux, coolant flow, pressure, temperature, and power level. Reactor instrumentation was classified as reactor safety circuit instrumentation, reactor process control instrumentation, and non-process and building environmental instrumentation. The reactor safety circuit instrumentation classification included visual readout devices, and were connected directly into the reactor safety circuits for automatic shutdown if process limits were exceeded. The reactor process control instrumentation provided information to operating personnel by visual readout, but did not operate the reactor safety circuits (HW-74095 Vol. 3).

Three separate safety circuits were designed to initiate the insertion of negative reactivity into the reactor when it exceeded preset limits or when a failure occurred. The safety circuits included the 1X safety circuit, manual trip, and the pressure monitor. The 1X system scramed the vertical and horizontal control rods. The manual trip was a scram push button, and the pressure monitor measured coolant flow continuity in each process tube.

Instrumentation was installed to measure the atmospheric pressure against the air pressure in the rear face, inner rod room, top of the reactor work area, and X-levels. Instrumentation was also used to monitor the reactor building exhaust airflow for radio-iodine. If, for example, the radioiodine levels were high, the fog spray system would engage. For additional information on the fog spray system refer to page 16. Another instrumentation system was the monitoring and measurement of radiation level of air borne particles in the exhaust air before and after air was filtered through the 117-KW Filter Building. An additional system monitored the compressed air supply system of the filter frame seals.

HEATING SYSTEM

The heating system for the 105-KW Reactor Building operated by recirculating heated reactor effluent through a heat exchanger. Heated water was pumped to the 165-KW Building for distribution to the heating coils and heaters and returned through supply and return headers to the 105-KW Reactor Building.

COOLING SYSTEM

The cooling system for the 105-KW Reactor Building included the process piping system designed to accommodate a water flow of 168,000 gallons of water per minute. Process piping included the inlet and effluent systems. The Columbia River was the only source of water for reactor operations. The raw river water was treated for purity prior to being used for reactor cooling operations.

Inlet System

Reactor operations created heat due to the absorption of energy released by neutrons and the absorption of gamma energy. Reactor heat was removed by circulating water through spaced tubes either in or attached to the shields. Cooling water for the reactor was pumped from the Columbia River at the 181-KW River Pump House, sent to the 183-KW Filter Plants for treatment, and then the 190-KW Process Pump House and on to the reactor.

The 181-KW River Pump House had the capability to pump 32,000 gallons per minute form each of its six pumps. Two, sixty-inch raw water lines extended from the pump house to the control building and then to the headhouse. In the 183-KW Filter Plant water was filtered and chemically treated to prevent film build-up in the reactor process tubes, and excessive corrosion of the fuel element cladding or process tubes. The Filter Plant was a multi-component facility consisting of the HeadHouse (183.1-KW), Focculator and Sedimentation Basin (183.2-KW), Filter Plant (183.3-KW), and Clearwells (184.4-KW).

The 190-KW Process Pump House pumped a minimum flow of 112,000 gallons per minute to the 105-KW Reactor for cooling operations. The 190-KW building was connected to the reactor by an underground tunnel that contained the process piping for the coolant systems. Once the water was used for reactor cooling it gravity flowed into the effluent system.

Effluent System

Temporary water storage was an essential part of the effluent system. The effluent system was designed to transport hot reactor water by gravity flow to the river. Because of the dissolved minerals, water treatment chemicals, and the entrainment of corrosion products from the surface of the reactor fuel and process tubes, hot effluent water from the reactor was held for a period of time in the 107-KW Retention Basins prior to its release into the Columbia River. The effluent flowed through a 72-inch line from the reactor. The 107-KW Retention Basins were the primary temporary water storage system for cooling water leaving the reactor. The retention basins were midway between the reactor and the river. The facility for the KW-Reactor contained three circular carbon-steel tank, 250 feet in diameter and 29 feet high. The retention basins were designed to allow the decay of short-lived radioisotopes and to hold up effluent flow with high radioactive isotope concentrations. If necessary, high radioactive isotopes were isolated and diverted by gravity to a crib. From the retention basins, the effluent was transported by gravity flow through outfall structures and into the river. Once in the river, the effluent water was discharged underwater to dilute the flow by mixing the effluent with river water (HW-74095 Vol. III).

THERMAL AND BIOLOGICAL SHIELDING

Heat was generated in the Thermal and Biological Shields from the absorption of energy released by neutrons and the absorption of gamma energy. The heat was removed by water circulated through tubes spaced at intervals either in or attached to the shielding. To improve the heat transfer, the thermal and biological shielding tubes were embedded in lead. Both, the Thermal and Biological Shields discharge cooling system were located on the outlet face of the reactor. (HW-74095 Vol. 3).

Thermal Shield

The Thermal Shield absorbed about 97 percent of the escaping radiant energy from the graphite stack. It was constructed of cast iron approximately 10-inches thick and designed to surround the graphite stack. It also contained blocks with _-inch stainless steel tubing inserted into them. Water was pumped through the tubing to provide a cooling system for the shield. The shield was water cooled to reduce the heat generated by the absorption of energy released by neutrons and the absorption of gamma energy.

Biological Shield

The Biological Shield was designed to absorb the majority of the energy that escaped from the Thermal Shield. The shield was water cooled to reduce the heat generated by the absorption of energy released by neutrons and the absorption of gamma energy. It was constructed of a steel framework enclosed by a 1-inch thick steel skin plates that were filled with high density concrete. It was 63-inches at the front and sides, 45-inches at the rear, and 83-inches at the top. The Biological Shield surrounded the Thermal Shield on all sides except the bottom.

SHUTDOWN MECHANISMS

Three shutdown mechanisms were used for reactor operations. Shutdown mechanisms were activated in the event of coolant loss, large power excursions, or an earthquake. The three separate shutdown procedures were Horizontal Control Rods, Vertical Safety Rods, and the Ball-3x System.

Horizontal Control Rods

Horizontal Control Rods were designed to control reactor power levels during normal fission process operations and maintain a balanced flux distribution during equilibrium operation (HW-74095 V0l. 3). The system added shutdown strength in the event of a scram. The rods were made up of three long sections that entered the reactor in a side to side (horizontal) direction to the fuel column. Rods were arranged in four vertical rows of six rods each, with the four corner locations empty. Twenty Horizontal Control Rods were required for operations. Sixteen rods were 44 feet 11 _ inches long and four were 24 feet 2 _ inches long. Required time for the Horizontal Control Rods to enter the reactor was about 60 seconds. Once the Horizontal Control Rods entered the reactor, cooling water was forced through the control rods at a rate of 12 gpm.

Vertical Safety Rods

Vertical Safety Rods were designed as a shutdown mechanism for controlling a reactor incident (HW-74095). The Vertical Safety Rods for the 105-KW Reactor differed from other reactors in that they were air-operated. Forty-one Vertical Control Rods were used in the KW-Reactor. Each rod assembly consisted of five stainless steel tubes filled with boron carbide. Tubes were screwed together to form a rod 46 foot 7-11/16-inches long. Each rod contained a piston head that traveled in a vertical cylinder. The cylinder contained an exhaust, bleed, relief and vent valves for operation of the rod. When air was added to the cylinder the rod was raised, the reverse occurred when air was removed from the cylinder. Once the trip signal was given by a coolant disturbance, the safety rods entered the reactor within about two seconds. The Ball 3X System was the safety backup for the Vertical Safety Rods.

Ball-3X System

The Ball-3x System was an emergency system slower in response time than the Vertical Safety Rod System. A complete coolant loss, manual action, or an earthquake initiated the Ball 3X System. Once initiated, the safety system inserted boron-steel balls into the vertical channels. From nine to 25 seconds were required to completely fill the channels with 3/8-inch nickel-plated carbon steelballs. This system was designed to shut the reactor down and hold it under nuclear control.

MODIFICATIONS

In 1960, confinement facilities were added to the reactor. The modification was designed to control the release of radioactive matter from the building in the event of a limited nuclear incident. This was accomplished by confining the flow of ventilation air to selected paths and to exhaust through filters prior to its release into the exhaust stack. The confinement system consisted of a fog spray, building ventilation and exhaust fan, 117 Filtration Facility, and instrumentation for controlling the system (HW-74095 Vol. 3).

Fog Spray

The fog spray system was located within the rear face enclosure and was designed to :

> create a fine spray of water to absorb halogen vapors released during any uranium fire, settle out airborne particulate matter released during a fuel element fire, wash down exposed surfaces within the rear face enclosure for the removal of contaminated particles, provide limited thermal cooling to exposed fuel elements, condense any steam that may be formed, to prevent pressure buildup in the area (HW-74095 Vol. 3).

The fog spray supplied about two inches of moisture every five minutes when activated.

DEACTIVATION

Deactivation of the 105-KW Reactor began in 1971 and continued until 1973. During this period the reactor was shut down, defueled, and the system deactivated.

CONCLUSION

Under the authorization of the Atomic Energy Commission , the 105-KW Reactor Building and associated buildings were constructed from 1952 to 1955. Because of its size, the 105-KW Reactor was known as a “Jumbo Reactor”. The increased size allowed it to operate at an increased production over its smaller predecessors. The larger size of the reactor also allowed the reactor to operate at reduced costs. The design of the K-Reactor series introduced several new concepts in reactor operations that included air operated Vertical Safety Rods and steel tank retention basins.

It is the conclusion of the U.S. Department of Energy that the 105-KW Reactor Building is eligible for inclusion in the National Register of Historic Places under Criterion A as a contributing property with in the Hanford Site Manhattan Project and Cold War Era Historic District.

References

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